

# SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F-21-R-42

**Name:** Lake Sinai

**County:** Brookings

**Legal Description:** T109N- R52W-Sec 3-4, 9-10

**Location from nearest town:** 1 mile west, 1½ miles north of Sinai, SD

**Dates of present survey:** June 29-July 1, 2009 (netting); Sept. 14, 2009 (electrofishing)

**Dates of last survey:** July 1-3, 2008 (netting); September 8, 2008 (electrofishing)

Primary Game Species	Other Species
Walleye	Black Bullhead
Yellow Perch	Common Carp
Smallmouth Bass	Northern Pike
	Bluegill
	Green Sunfish
	Hybrid Sunfish
	Black Crappie

## PHYSICAL DATA

**Surface area:** 1,719 acres

**Maximum depth:** 33 feet

**Volume:** No data

**Contour map available:** Yes

**OHWM elevation:** None set

**Outlet elevation:** None set

**Lake elevation observed during the survey:** Full

**Beneficial use classifications:** (4) warmwater permanent fish propagation, (7) immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation and stock watering.

**Watershed area:** No data

**Mean depth:** 17 feet

**Shoreline length:** No data

**Date mapped:** 2002

**Date set:** NA

**Date set:** NA

## Introduction

Lake Sinai is a natural glacial lake located just northwest of the town of Sinai in west central Brookings County. It was named by county commissioners who felt the surrounding land resembled the land around Mount Sinai in the Holy Land. Heavy precipitation in the late 1980s doubled the size of the lake.

## Ownership of Lake and Adjacent Lakeshore Properties

Lake Sinai is listed as meandered public water in the State of South Dakota Listing of Meandered Lakes and the South Dakota Department of Game, Fish, and Parks (GFP) manages the fishery. GFP also owns and manages Game Production Areas and Lake Access Areas on the north, south, and east sides of the lake. The remainder of the shoreline is privately owned.

## Fishing Access

The North Lake Access Area has a double lane boat ramp with a dock, a large parking area, and a public toilet. There is limited shore fishing access.

## Field Observations of Water Quality and Aquatic Vegetation

Water clarity was excellent with a Secchi depth measurement of 3 m (118 in). Some suspended algae and beds of sago pondweed (*Potamogeton pectinatus*) were observed around the lake and there are still considerable areas of flooded trees and brush.

## **BIOLOGICAL DATA**

### Methods:

Lake Sinai was sampled on June 29-July 1, 2009 with five overnight gill-net sets and nine overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh ( $\frac{3}{4}$  in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. The gill nets are 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh ( $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1, 1 $\frac{1}{4}$ , 1 $\frac{1}{2}$ , and 2 in) monofilament netting. Two hours of nighttime electrofishing were done on September 14, 2009 to evaluate walleye recruitment. Sampling sites are displayed in Figure 3. From the gill-net catch, otoliths were collected from walleyes and yellow perch and aged for 5 fish in each 10-mm increment in order to estimate growth rates and age structure.

### Results and Discussion:

## **Gill Net Catch**

Yellow perch (77.1%) and walleye (19.9%) were the most common species sampled in the gill nets this year and totaled 97% of the sample. Smallmouth bass, common carp, and white sucker (Table 1) were also sampled.

**Table 1.** Total catch from five overnight gill net sets at Lake Sinai, Brookings County, June 29-July 1, 2009.

Species	No.	%	CPUE <sup>1</sup>	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Yellow Perch	209	77.1	41.8	±10.1	52.3	76	6	109
Walleye	54	19.9	10.8	±6.9	14.9	2	0	85
Smallmouth Bass	6	2.2	1.2	±1.0	0.3	--	--	--
Common Carp	4	1.5	0.8	±0.5	1.6	--	--	--
White Sucker	2	0.7	0.4	±0.6	0.0	--	--	--

\*10 years (1999-2008)

<sup>1</sup> See Appendix A for definitions of CPUE, PSD, RSD-P, and mean Wr.

**Table 2.** Catch per unit effort by length category for various fish species captured with trap nets in Lake Sinai June 29-July 1, 2009.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Yellow Perch	--	41.8	10.0	29.2	2.6	41.8	±10.1
Walleye	0.2	10.6	10.4	0.2	--	10.8	±6.9
Smallmouth Bass	0.2	1.0	0.8	--	0.2	1.2	±1.0
Common Carp	--	0.8	0.4	--	0.4	0.8	±0.5
White Sucker	--	0.4	--	--	0.4	0.4	±0.6

Length categories can be found in Appendix A.

## **Trap Net Catch**

Yellow perch (38.5%), smallmouth bass (21.2%), and walleye (13.5%), were the most abundant species in the trap net sample (Table 3). Other species sampled included, black bullhead, black crappie, common carp, green sunfish, and northern pike. The total number of fish captured in the trap nets was low (only 5.7 fish/net average), however, CPUE for individual species was within previously observed ranges.

**Table 3.** Total catch from nine overnight trap net sets at Lake Sinai, Brookings County, June 29-July 1, 2009.

Species	No.	%	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Yellow Perch	20	38.5	2.2	±1.1	9.1	90	0	100
Smallmouth Bass	11	21.2	1.2	±0.6	1.8	--	--	--
Walleye	7	13.5	0.8	±0.2	2.1	--	--	--
Black Bullhead	5	9.6	0.6	±0.2	99.7	--	--	--
Black Crappie	4	7.7	0.4	±0.4	0.2	--	--	--
Common Carp	3	5.8	0.3	±0.2	1.6	--	--	--
Green Sunfish	1	1.9	0.1	±0.1	0.2	--	--	--
Northern Pike	1	1.9	0.1	±0.1	0.1	--	--	--

\*7 years (2002-2008)

**Table 4.** Catch per unit effort by length category for various fish species captured with trap nets in Lake Sinai June 30-July 1, 2009.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Yellow Perch	--	2.22	0.2	2.0	--	2.2	±1.1
Smallmouth Bass	0.3	0.9	0.7	--	0.2	1.2	±0.6
Walleye	--	0.8	0.6	0.1	0.1	0.8	±0.2
Black Bullhead	--	0.6	0.4	0.1	--	0.6	±0.2
Black Crappie	--	0.4	0.2	0.2	--	0.4	±0.4
Common Carp	--	0.3	0.3	--	--	0.3	±0.2
Green Sunfish	--	0.1	--	0.1	--	0.1	±0.1
Northern Pike	--	0.1	0.1	--	--	0.1	±0.1

Length categories can be found in Appendix A.

## Walleye

**Management objective:** Maintain a walleye population with a gill-net CPUE of at least 15, a PSD range of 30-60, and a growth rate of 14 inches by age-3.

Walleye gill-net CPUE changed little in 2009 and remains below the management objective and ten-year average (Table 5). Fish from the 2007 year class comprised the majority of the sample and the mean length of all walleyes sampled was 30 cm (12 in) (Figure 1).

Walleye growth has slowed some over the last 10 years (Table 6); however, age-2+ fish are still averaging about 300 mm (12 in) in their third season (Table 6). In 2008, condition (mean Wr) was at the low end of the 10-year period (Table 5).

**Table 5.** Walleye gill-net CPUE, PSD, RSD-P, and mean Wr in Lake Sinai, Brookings County, 2000-2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean*
CPUE	18.3	32.7	30.7	14.8	6.0	5.8	6.2	5.5	11.4	10.8	14.9
PSD	67	2	62	71	64	48	46	46	12	2	44
RSD-P	17	0	1	7	18	10	14	15	7	0	9
Mean Wr	84	98	98	84	84	87	86	89	82	85	88

\*10 years (1997-2006)

**Table 6.** Weighted mean length at capture (mm) for walleye captured in gill nets in Lake Sinai, Brookings County, 2003-2009. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

Year	1	2	3	4	5	6	7	8	9	10	11	12
2009 (54)	218 (1)	283 (36)	338 (14)	369 (1)	398 (2)	--	--	--	--	--	--	--
2008 (57)	208 (14)	299 (36)	--	404 (4)	--	--	573 (2)	--	--	--	655 (1)	--
2007 (22)	221 (10)	--	345 (5)	--	467 (6)	--	567 (1)	--	--	--	--	--
2006 (37)	--	284 (20)	395 (4)	422 (5)	489 (2)	554 (2)	585 (1)	654 (3)	--	--	--	--
2005 (35)	194 (14)	314 (6)	364 (6)	409 (5)	440 (2)	661 (1)	--	687 (1)	--	--	--	--
2004 (24)	251 (4)	341 (5)	408 (8)	406 (3)	537 (1)	553 (1)	615 (1)	--	704 (1)	--	--	--
2003 (59)	215 (1)	339 (17)	422 (5)	502 (1)	455 (32)	558 (2)	606 (1)	--	--	--	--	--

In 2009, natural reproduction produced a moderate year class similar to 2008 (Table 7). The length of age-0 walleyes was larger than 2006-2008 and condition was similar to previous years. Yearling CPH was low and the fish were small. Walleyes from the large 2007 year class (age-2) were still common in the electrofishing catch this year.

**Table 7.** Age-0 and age-1 walleyes sampled during 2 hours of nighttime electrofishing on Lake Sinai, Brookings County, 2000-2009.

Year	Stocking	Age-0 CPH	80% C.I.	% stocked	Mean length (range; mm)	Wr	Age-1 CPH	80% C.I.	Mean length (range; mm)	Wr
2009	none	29	21-37		185 (156-207)	96	2	1-3	242 (213-275)	90
2008	none	31	21-41		162 (135-185)	100	34	25-43	249 (205-290)	81
2007	none	113	63-139		161 (122-203)	95	17	11-23	282 (251-340)	79
2006	fingerling	291	199-393	96	175 (149-221)	85	0	--	--	--
2005	none	9	5-13		194 (163-212)	90	64	42-84	251 (223-294)	81
2004	fingerling	87	35-139	<sup>1</sup>	134 (110-160)	95	4	1-6	294 (270-314)	90
2003	none	19	12-26		209 (198-223)	101	22	18-26	317 (274-354)	87
2002	none	122	102-141		180 (147-206)	97	12	4-21	282 (200-315)	90
2001	none	59	36-81		169 (138-222)	105	6	3-9	324 (311-339)	97
2000	none	5	2-8		162 (152-174)	80	1	0-2	195	67

<sup>1</sup> Oxymerine killed immersed fingerlings so no marking of stocked fish was done.

## **Yellow Perch**

**Management objective:** Maintain a yellow perch population with a gill-net CPUE of at least 50 with a PSD range of 30-60.

Yellow perch gill-net CPUE increased considerably in 2009 and is approaching the management objective (Table 8). The perch sampled ranged in length from 16-29 cm (6.3-11.4 in) and were 2-4 years old (Figure 2 and Table 9). These fish were naturally produced since no stocking was done during this period. Growth is faster than regional, statewide and large lakes means (Table 9) with fish reaching 20 cm (8 in) between age-2 and age-3. Yellow perch relative weight (Wr) is near the ten year mean at 100. Several reports of good fishing in summer of 2009 were noted.

**Table 8.** Yellow perch gill-net CPUE, PSD, RSD-P and mean Wr in Lake Sinai, Brookings County, 2000-2009.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean*
CPUE	82.0	40.2	127.7	77.3	65.0	40.8	28.0	11.0	13.6	41.8	52.3
PSD	59	94	70	24	82	85	76	73	52	90	65
RSD-P	10	10	26	1	0	28	23	2	19	0	13
Mean Wr	108	97	111	94	99	107	98	107	101	100	103

\*10 years (1999-2008)

**Table 9.** Weighted mean length at capture (mm) for yellow perch captured in gill nets in Lake Sinai, Brookings County, 2003-2009. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

Year	1	2	3	4	5	6	7	8	9
2009 (208)	--	208 (188)	251 (17)	276 (3)	--	--	--	--	--
2008 (67)	132 (40)	220 (13)	255 (14)	--	--	--	--	--	--
2007 (44)	146 (12)	221 (29)	247 (3)	--	--	--	--	--	--
2006 (169)	143 (24)	211 (83)	224 (20)	266 (5)	268 (35)	294 (2)	--	--	--
2005 (246)	128 (27)	204 (75)	225 (15)	248 (125)	287 (2)	281 (2)	--	--	--
2004 (261)	127 (39)	194 (34)	226 (182)	247 (6)	--	--	--	--	--
2003 (59)	--	186 (253)	208 (43)	243 (7)	235 (3)	262 (3)	--	--	--

## All Species

Only eight species were sampled in Lake Sinai in 2009. CPUE for most species was similar to 2008 (Table 10). Rough fish and bullheads are not a problem at this time.

**Table 10.** Gill-net (GN) and trap-net (TN) CPUE for all fish species sampled in Lake Sinai, Brookings County, 2000-2009.

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
COC (GN)	--	--	5.2	3.0	4.8	1.2	1.2	--	0.2	0.8
COC (TN)	*	*	2.0	5.2	1.7	0.9	0.1	1.0	0.3	0.3
BLB (GN)	134.7	39.8	49.5	32.3	5.3	0.2	0.2	0.5	--	--
BLB (TN)	*	*	634.0	45.5	9.9	3.9	2.5	1.8	0.3	0.6
NOP (GN)	--	1.7	0.5	1.5	0.3	0.7	0.8	--	0.2	--
NOP (TN)	*	*	--	0.1	0.1	0.4	--	0.3	--	0.1
GSF (GN)	--	--	--	--	--	--	--	--	--	--
GSF (TN)	*	*	1.1	--	--	0.1	--	0.3	0.2	0.1
HYB (GN)	--	--	--	--	--	--	--	--	--	--
HYB (TN)	*	*	0.4	0.1	0.1	--	--	0.1	--	--
BLG (GN)	--	--	--	--	--	--	--	--	--	--
BLG (TN)	*	*	0.4	0.2	0.2	0.2	0.8	1.9	0.4	--
SMB (GN)	--	--	--	--	--	0.3	0.2	1.0	1.0	1.2
SMB (TN)	*	*	--	--	0.2	0.9	2.0	5.2	4.6	1.2
BLC (GN)	--	--	--	--	--	--	0.2	--	--	--
BLC (TN)	*	*	--	--	--	--	0.9	0.2	--	0.4
YEP (GN)	82.0	40.2	127.7	77.3	65.0	40.8	28.0	11.0	13.6	41.8
YEP (TN)	*	*	42.8	6.6	2.6	6.4	1.8	1.5	2.0	2.2
WAE (GN)	18.3	32.7	30.7	14.8	6.0	5.8	6.2	5.5	11.4	10.8
WAE (TN)	*	*	0.5	1.4	0.8	1.1	1.8	5.6	3.2	0.8

\*Trap nets were not used from 1998-2001

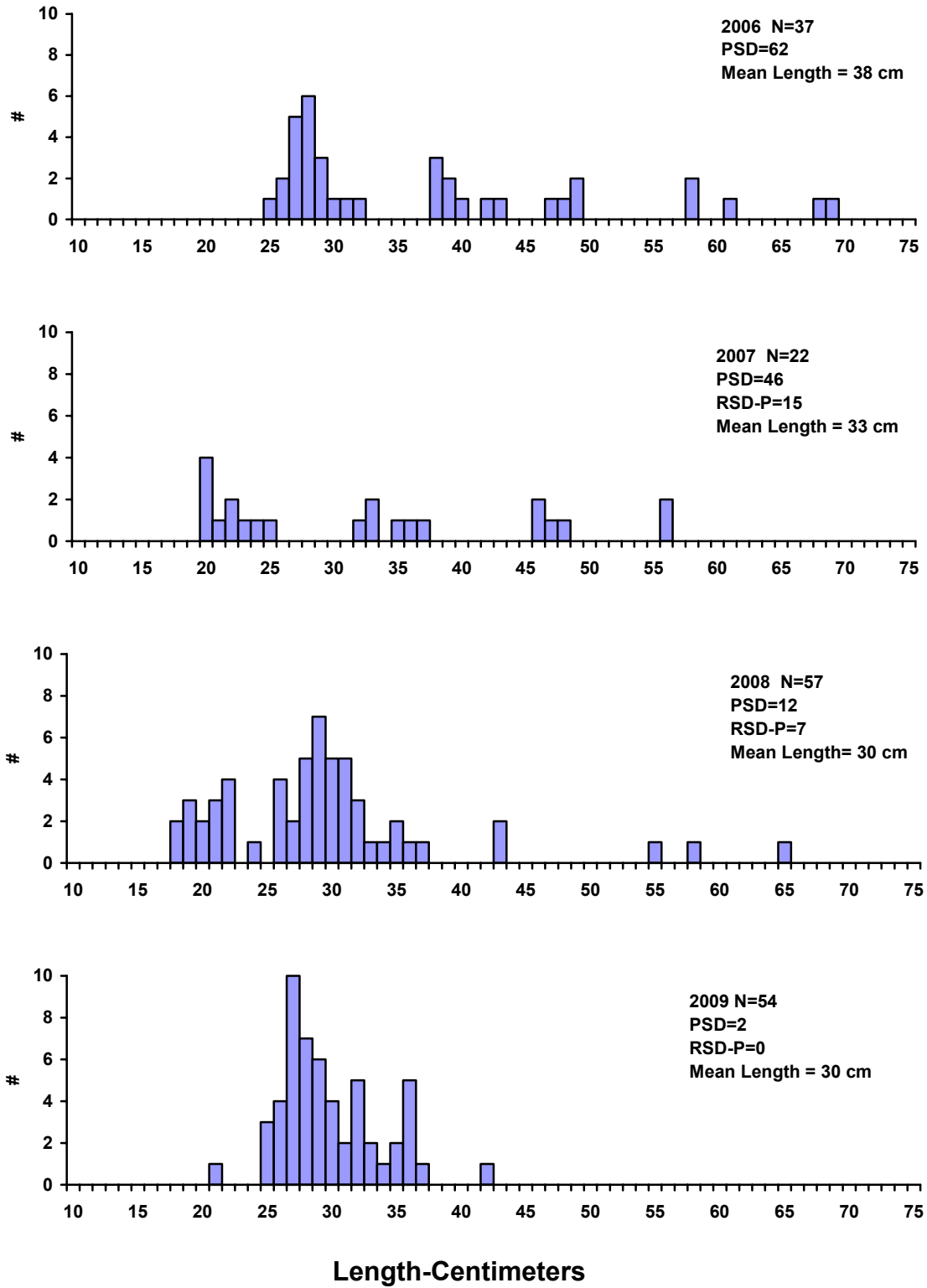
COC (Common Carp), BLB (Black Bullhead), NOP (Northern Pike), GSF (Green Sunfish), HYB (Hybrid Sunfish), BLG (Bluegill), SMB (Smallmouth Bass), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye)

**Table 11.** Stocking record for Lake Sinai, Brookings County, 1991-2009.

<b>Year</b>	<b>Number</b>	<b>Species</b>	<b>Size</b>
1991	32,115	Yellow Perch	Fingerling
1992	30,399	Yellow Perch	Fingerling
	22,480	Walleye	Lrg. Fingerling
1993	19,644	Walleye	Lrg. Fingerling
1994	30,950	Bluegill	Fingerling
	19,268	Walleye	Lrg. Fingerling
1995	32,000	Bluegill	Fingerling
	60,000	Largemouth Bass	Fingerling
1996	1,994	Bluegill	Fingerling
	192,540	Walleye	Fingerling
1998	2,400,000	Walleye	Fry
1999	11,689	Yellow Perch	Adult
2002	65	Smallmouth Bass	Adult
2003	57,470	Smallmouth Bass	Fingerling
2004	170,200	Walleye	Fingerling
	13,440	Smallmouth Bass	Fingerling
2005	58,340	Smallmouth Bass	Fingerling
2006	173,060	Walleye	Fingerling

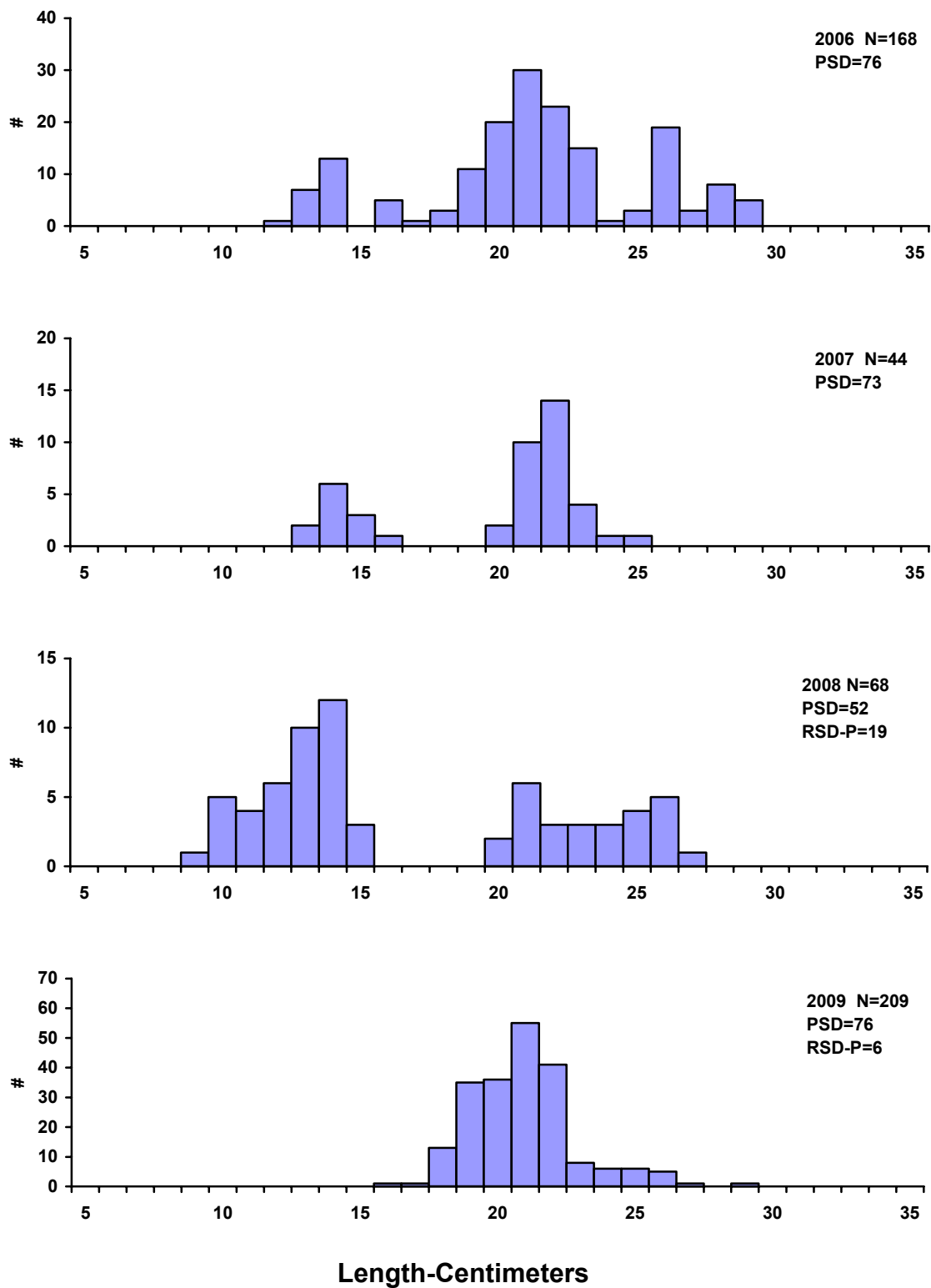
### **MANAGEMENT RECOMMENDATIONS**

1. Monitor the Lake Sinai fishery by conducting annual summer netting surveys to monitor the general fish population and fall electrofishing surveys to monitor walleye recruitment.
2. Achieve the walleye management objective stocking fry or fingerlings into voids of natural reproduction as determined by fall electrofishing surveys.
3. Consider stocking fry, fingerling, or adult yellow perch if natural reproduction fails to maintain population density at objective levels.

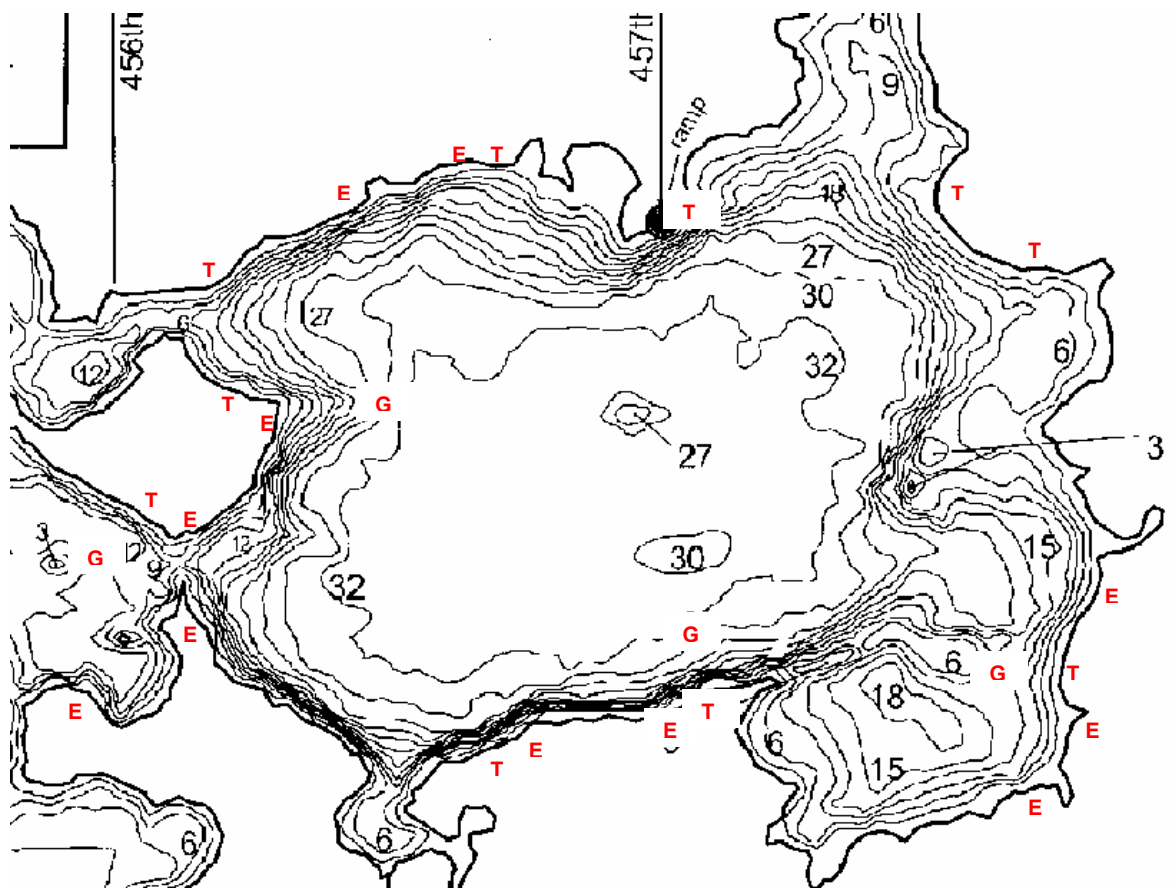


**Figure 1.** Length frequency histograms for walleyes sampled with gill nets in Lake Sinai, Brookings County, 2006-2009.





**Figure 2.** Length frequency histograms for yellow perch sampled with gill nets in Lake Sinai, Brookings County, 2006-2009.



**Legend**

Gill Net Sites: **G**

Trap Net Sites: **T**

Electrofishing Sites: **E**

**Figure 3.** Sampling locations on Lake Sinai, Brookings County, 2009.

**Appendix A.** A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

**Catch Per Unit Effort (CPUE)** is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill-net nights of effort, catch per hour of electrofishing, etc.

**Proportional Stock Density (PSD)** is calculated by the following formula:

$$\text{PSD} = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

**Relative Stock Density (RSD-P)** is calculated by the following formula:

$$\text{RSD-P} = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25	38	51	63	76
Sauger	20	30	38	51	63
Yellow perch	13	20	25	30	38
Black crappie	13	20	25	30	38
White crappie	13	20	25	30	38
Bluegill	8	15	20	25	30
Largemouth bass	20	30	38	51	63
Smallmouth bass	18	28	35	43	51
Northern pike	35	53	71	86	112
Channel catfish	28	41	61	71	91
Black bullhead	15	23	30	38	46
Common carp	28	41	53	66	84
Bigmouth buffalo	28	41	53	66	84
Smallmouth buffalo	28	41	53	66	84

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For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

**Relative weight (Wr)** is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.